

## Rule Updates

Four Missouri Well Construction Rule amendments are moving through the rulemaking process. Draft rules are available on the division's webpage at [dnr.mo.gov/geology/geosrv/geo-rules-in-dev.htm](http://dnr.mo.gov/geology/geosrv/geo-rules-in-dev.htm).

The order of rulemaking regarding the Disciplinary Action and Appeal Procedures (10 CSR 23-1.075), was printed in the *Missouri Register* July 15, 2013, and was published in the Code of State Regulations July 31. The rule becomes effective August 30, 2013.

The proposed rulemaking for heat pump regulations (10 CSR 23-5.010 – 10 CSR 23-5.080) was published in the *Missouri Register* July 1, 2013. The public hearing was held August 1, and the comments will be presented to the Board at its August 23, 2013, meeting in Springfield, Mo.

Continuing Education program rulemaking is in the beginning stages. The proposal will require all permittees to obtain continuing education credits to renew their permit. More information will be provided regarding this topic in the future.

Public Well Permit Requirement rulemaking also is in the beginning stages. More information will be provided regarding this topic in the future. The proposal will require a "public well permit" to drill or install pumps in public wells.

Questions regarding these rulemakings or the rulemaking process should be directed to Sheri Fry.

## Permit and Vehicle Renewals Now Online

In an effort to improve customer service and convenience, permit and vehicle cards may be renewed online by going to [dnr.mo.gov/mowells](http://dnr.mo.gov/mowells) and selecting the "Renew Permits" option. This option is available only for those who have no changes (address, phone number, permit, etc.) that need to be made on their permit, provided no outstanding violations exist. Contractors will be able to pay for permits, vehicle cards and late fees that have been assessed that are within 60 days before or 30 days after the renewal date. Contractors must print their permit and vehicle cards before leaving the site. It is not possible to return to the site to print cards after leaving the site.

Questions or concerns should be addressed to Sheri Fry or Jeannie Hoyle.

## Well Installation Board News

The Missouri Well Installation Board held its quarterly meeting May 10, 2013, at the Division of Geology and Land Survey in Rolla. The Board voted on two permit appeals and received updates about section activities and proposed rulemakings. The Board voted to schedule the next quarterly meeting for 10 a.m., Friday, August 23, 2013, at the Department's Southwest Regional Office, 2040 West Woodland, in Springfield, Mo.

A subsequent meeting will be held November 1, 2013, at the Division of Geology and Land Survey, Ozarkite Conference Room, 111 Fairgrounds Road, Rolla. Open session will begin at 10 a.m.

## State Park Well Plugging Program

At the February 18, 2013, Well Installation Board Meeting in Lake Ozark, the division announced the implementation of a project to properly plug multiple wells within Missouri State Parks. The purpose of the project was to identify abandoned



wells at state parks, to properly plug the wells to protect groundwater resources from potential contamination, and to eliminate a potential physical hazard to park workers and visitors. The division utilized excess Groundwater

Protection Fund monies, resulting from fees associated with certification of cost share wells during the drought of 2012, to contract through a competitive bidding process with permitted well installation and pump contractors to perform the work. A total of nine abandoned wells were plugged at five state parks: Cuivre River (three wells), Stockton (one well), Big Sugar Creek (one well), Lake of the Ozarks (three wells), and Battle of Athens (one well). Two additional abandoned wells were identified and adopted into the Water Resources Center's groundwater observation network. All priority wells identified by Missouri State Parks have been properly plugged, and the project is complete. Eleven potential contamination sources have been eliminated by this project. The division feels this has been a wise use of the Groundwater Protection Fund and promotes the department's mission of protecting Missouri's critical groundwater resources.

## Welcome Contractors

The following individuals are now part of the Missouri Department of Natural Resources' permitted contractor community:

Albright Heating & Air – Mark Niles  
Boessen Underground – Christopher Williams  
Burns & McDonnell – Mathew Crawford,  
Thomas Moriaty, Kyle Perino  
Geo Serve Inc – Matthew Palsgrove, Samuel Redmond  
Continental Coal – Philip Tearney  
Golder Associates – Brett Forthaus  
Kennedy/Jenks – Eric Mosley  
Trent Well Drilling – David Trent

## Welcome Apprentice Contractors

The following individuals are now part of the Missouri Department of Natural Resources' permitted apprentice contractor community:

Ark-MO Well Drilling – Michael Tipton, Wesley Dickey  
Brotcke Well and Pump – Joshua Langston, Jeffrey Parker  
Burge Irrigation – Taylor Burge, Zach Clubb  
Burns & McDonnell – Jason Yeager  
Compton Irrigation – Larry Compton, Paul Allen  
Harper Drilling – Eric Bernt  
Huston's Pump Service – Clinton Calcote  
Layne Christensen – Jason Gerwing  
Russom Irrigation – Forrest Jarvis  
Smith & Co. – Felix Deken  
TRC Environmental – Richard Wetherbee

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## Chain of Custody Requirements and Monthly Analysis Reports for Special Area 2

Part 10 CSR 23.3100 (6)(D) of the Missouri Well Construction Rules states, "A copy of the chain of custody form shall be submitted to the division with the well certification report form to document sampling has occurred." Adherence to this rule this has proven to be impractical for drilling and pump contractors for several reasons. There are cases where delays occur in retrieving the sample, or someone other than the driller collects the sample. Additionally, instances occur when contractors must submit a certification record before the Chain of Custody form is available in order to avoid a late fee. Therefore, it is not mandatory that a Chain of Custody form be sent with the well record. It has proven more practical for the contractor to submit a Chain of Custody form with the sample results. It should be noted that the Chain of Custody form is a legal document that MUST be submitted. The division keeps the form, the well record, and sample results indefinitely. If the contractor has arranged with the lab they use to automatically copy the Wellhead Protection Section with sample results, the lab should also be instructed to submit the Chain of Custody form. An incomplete or missing form will delay the certification of a well record. The drilling contractor is ultimately responsible to provide the sample results and the Chain of Custody form for any well drilled in Special Area 2.

## Farewell

The following individuals are no longer permitted to operate as contractors according to the Water Well Drillers Act and Well Construction Regulations:

Acklin, Craig  
Anderson Brothers Heating & Cooling – David Anderson  
Burns & McDonnell – Emily Pohlman, Stephen Hoffine  
Cardno ATC – Brian Mana  
Central Missouri Plumbing – Kevin Frank  
Classic Aire Care – Thomas Hoffmann  
Davenport, Darriel  
Davis Environmental Drilling – Roland Davis  
Emily, Floyd (Bud)  
Energy America – William Smith, Kirby McKenzie  
Enlink Geoenergy Services – George Burrier  
Environmental Resources – Keven Kowalewski  
Environmental Works – Trevor Penner  
Envirotech Engineering – Tony Horner  
Ground Source Systems – Ronald Janke, John Reed  
Harding ESE – Jack Friesner  
Harriss Drilling – Chad Dutton  
Herst & Associates – Rachael Haynes  
J R Brown LLC – Rodney Brown  
Jet Drilling – Jeffrey Bingham  
Koehler Engineering – Thomas Nelson  
Larsen & Associates – Paul Gallagher Jr  
Lebanon Pump & Drilling – Leonard Johnson  
Leftys Pump & Drilling – Joe Webb  
Mid-West Hydro – James Luther  
Midwest Mechanical – Larry Logan  
Norton, Don  
Pense Brothers Drilling – Lanny Warren  
PSC Industrial – Jeremy Bignall  
Rhodes Plumbing & Pump – John Rhodes  
Rueff, Ardel  
S & K Plumbing – Greg Stockdale  
Satterfield, Ira  
Schroeder Rotary Drilling – James Wright  
Seeger, Daren  
Shaw E & I – Tony Bryant  
Sunbelt Environmental – Dylan Hall  
Swanson, Martin  
Taylor's Plumbing Services – Keith Taylor  
Wright, William  
WSP Environment & Energy – Jerome McSorley

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In the past, a monthly courtesy report was sent to drillers who submitted well records for Special Area 2 wells (Newton and Jasper counties). This report listed the wells where the sample analysis results and Chain of Custody form had not been received by the division. This practice will be replaced by sending a letter to the drilling contractor for each SA2 well where the sample results and Chain of Custody form have not been received. This is similar to the practice used when an incomplete well record is received and has proven to be more efficient. The report issued in July 2013 will be the last. As always, a drilling contractor is welcome to contact our office directly (Matthew Parker at 573-368-2170) should they wish to verify whether the results and Chain of Custody form have been received for a well they constructed.

## Well Assistance

The Wellhead Protection Section often receives inquiries from citizens of Missouri asking if any well drilling or plugging assistance programs are available. The Section is aware of the following two programs offered through the U.S. Department of Agriculture that may provide well drilling assistance in southwest Missouri. For more information please contact these agencies directly.

USDA, Natural Resource Conservation Service (NRCS)  
Springfield, MO office: 417-831-5246, Ext. 3

USDA, Rural Development Program  
Springfield, MO office: 417-831-5246, Ext. 4

Information about additional assistance programs will be provided in future *Connection* newsletter issues as it becomes available.

## Public Water Supply Pilot Holes

The number of pilot holes drilled for public water supply wells has increased in recent years. There are a variety of possible explanations for this increase. As population increases and water consumption rises, communities in areas with marginal or unknown water quality or quantity often drill pilot holes to assess the feasibility of adding additional water supply wells. Although a pilot hole is a cost-effective means to help a water supplier determine whether or not to drill a public well, many pilot holes are never reconstructed into a public well. The result is a pilot hole that is left open for long periods of time. Many pilot holes have little casing and little to no grout seal, and they may have total depths in excess of 1,000 feet, posing a risk of contaminants entering the groundwater.

Although pilot holes have been constructed for some time in Missouri, they do not meet Missouri Well Construction Rules standards. In order to be in compliance with the rules, all pilot holes that are not completed into public water supply wells within 60 days must at a minimum be constructed to domestic water well standards or properly plugged. This will ensure that new pilot holes do not become a threat to groundwater resources, even if they cannot be completed as a public water supply well for an extended period of time.

A new form, "Pilot Hole for a Public Water Supply Well Certification Record," is available to report the construction of a pilot hole to domestic water well standards. Submittal of this form is necessary only when the pilot hole is not completed as a public water supply well for more than 60 days after construction. When the pilot hole is completed for its intended use, submit a "Public Well/High Yield Record" form. These forms can be found online:  
[dnr.mo.gov/forms/#wellheadprotection](http://dnr.mo.gov/forms/#wellheadprotection).

Failure to complete a new pilot hole to a minimum of domestic well standards within 60 days will result in a "Letter of Warning" and possible enforcement action. This policy took effect August 1, 2013.

## Abandoned Well Plugging Grant Program

The department's Public Drinking Water Branch in Jefferson City administers a grant program to plug drinking water wells that have been abandoned. The number of abandoned drinking water wells in Missouri is estimated to be as many as 500,000. Abandoned water wells have many risks associated with them. The chief risk is the threat posed to human health. In addition to the physical hazards large diameter wells pose to children and adults, the threat of contamination to underlying groundwater reservoirs from abandoned wells is a significant concern to communities across Missouri. These structures can provide a direct conduit for contamination to enter a groundwater reservoir, which once contaminated can be costly to clean. In worst case scenarios, a groundwater reservoir may need to be abandoned as a source of raw water due to excessive contamination.

The federal Safe Drinking Water Act authorizes the Missouri Department of Natural Resources to allocate a portion of the Missouri Drinking Water State Revolving Fund to promote source water protection awareness, education and implementation. Safeguarding groundwater reserves by properly plugging abandoned water wells is one common sense step communities can take to increase protection to this vital resource. More than 1,100 public water systems in Missouri, serving approximately 1.7 million citizens, use groundwater as the sole or primary source of raw water for their community.

### Eligible Costs

Actual costs of plugging abandoned public, domestic and multiple family wells are reimbursable through this grant program. Public outreach, incentives and administrative costs for the approved projects are also eligible for funding pending department approval. Projects must be pre-approved to be eligible for reimbursement.

- Reimbursement for plugging public water supply wells is limited to 75% of the total cost per well or a maximum of \$10,000 per well, whichever amount is less.
- Reimbursement for plugging domestic or multiple family wells is generally a maximum of \$1,000 per well.
- Reimbursement for information brochures, newsletters or similar material used for public outreach efforts is also eligible.

### Grant Process

The application for the grant must be submitted by the utility company, city, public water district or entity that owns or operates the public water supply. Review of the project application typically takes one month from when the application is received by the department. Applicants are notified following the review period whether the submitted project has been selected for funding or if revisions are necessary for a reimbursement grant. Grant recipients should expect to receive an award package approximately two months from the time the application was initially received. For more information on qualifications and how to apply for grants, please contact the Public Drinking Water Branch's Source Water Protection and Assessment Coordinator at 573-526-0269 or 573-751-5331.

# St. Peter Sandstone

This is the first installment in a series of three articles that describe the geology and mineral resource potential of the St. Peter Sandstone in Missouri. This article includes an introduction to the St. Peter Sandstone and a geologic summary. The second article will cover aquifer characteristics and industrial usage. The final article will include mining information and will summarize recent evaluation findings conducted by the Missouri Geological Survey.

## Introduction

The St. Peter Sandstone is a sedimentary rock formation belonging to the Ordovician System, composed almost entirely of silica in the form of quartz sand grains. In Missouri the St. Peter Sandstone is well-sorted and fine- to medium-grained with silica content averaging nearly 99 weight percent, thus making it a preferred industrial sand and silica source (Dake, 1918). It has been produced in Missouri for the last 140 years. More than 65 million short tons of St. Peter having an estimated present value of \$2 billion have been mined in Missouri from the 1870s to present. In 2008, more than 700,000 short tons of St. Peter, at a value in excess of \$20 million, were produced from Missouri (U.S. Geological Survey, 2011). St. Peter Sandstone was used originally for the manufacture of glass. Its dominant use recently has been as a fracture proppant in oil and gas well stimulation, nationwide. The geographic distribution of the St. Peter Sandstone in the subsurface and in outcrop is shown in Figure 1.



Figure 1. Geographic distribution of St. Peter Sandstone in subsurface and in outcrop in the United States, adapted from Dake, 1921. Width of outcrop band is exaggerated.

## Geology

The St. Peter Sandstone is typically a well-sorted, friable, ultra-pure, fine- to medium-grained, quartzose sandstone. The sand grains are well-rounded, highly spherical and characteristically frosted (Thompson, 1991). They generally vary in size from 2 to 0.08 millimeters diameter; that is, from No. 10 to No. 200 U.S. Standard Sieve Series wire cloth size designations. Bedding is indistinct, and the formation appears massive throughout. The rock is cross-bedded and ripple-marked locally. The formation is generally porous, permeable and mostly unfossiliferous in Missouri (Thompson, 1991). Figures 2 and 3 show, respectively, the St. Peter in outcrop, and raw grains under magnification.

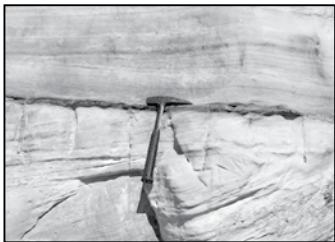


Figure 2. St. Peter Sandstone outcrop in Pacific, Missouri. Rock hammer provides scale.

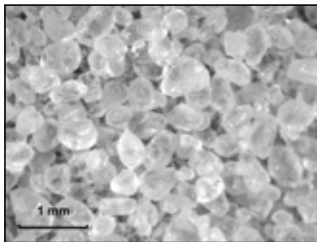


Figure 3. St. Peter sand grains unwashed and unsorted from Pacific, Missouri. Scale bar is one millimeter long.

SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	MgO	LOI	Total
98.88	0.19	0.35	0.13	0.11	0.34	100.00

Figure 4. Average chemical composition by weight percent of 22 unwashed samples of St. Peter Sandstone from different Missouri outcrop locations. Based on data from Dake (1918).

The St. Peter Sandstone is composed almost entirely of silica, otherwise known as silicon dioxide (SiO<sub>2</sub>) or quartz. In Missouri, the silica content is typically not less than 96 weight percent, with many areas higher than 99 percent. The iron oxide content is often less than 0.1 weight percent. Figure 4 is a table showing the average chemical composition by weight percent of 22 unwashed samples from different Missouri outcrop locations (Dake, 1918).

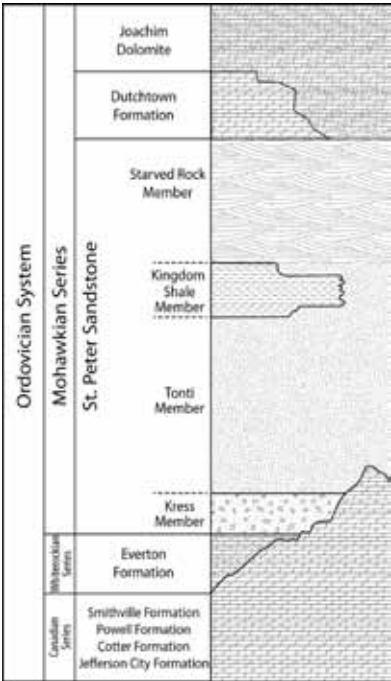


Figure 5. Representative geologic column of the St. Peter Sandstone and bounding units. Adapted from Thomson (1995).

The St. Peter Sandstone in Missouri belongs to the Mohawkian Series of the Ordovician System and comprises the following four members, listed from top to bottom: Starved Rock Member, Kingdom Shale Member, Tonti Member and Kress Member. Figure 5 is a representative geologic column of the St. Peter Sandstone in Missouri.

The Starved Rock and the Tonti are the two dominant high-purity sandstone members. Not all of the members are present in the St. Peter throughout its distribution. In southeastern Missouri, the Tonti member of the St. Peter rests, possibly conformably, on the Everton Formation, and is conformably overlain by the Joachim Dolomite. North of Jefferson County, the Kress Member, informally named the “detrital zone,” is disconformable on the eroded surface of Ibexian (Canadian) Series strata. In some places in the subsurface of northern Missouri, two members, the Starved Rock Member and Tonti Member, are present and sometimes separated by the Kingdom Shale Member (Thompson, 1995). According to Thompson (1995), “The Starved Rock is an elongate barrier bar overlying the more wide-spread ‘sheet-sand’ of the Tonti Member.” The depositional environment of the St. Peter is much debated. It has characteristics of both eolian and marine origin. It is likely a combination of both, beginning as an expansive eolian dune field that was overtaken and reworked by a marine transgression and transformed into a series of marine bar deposits, oriented northeast to southwest.

The St. Peter Sandstone aquifer characteristics and industrial usage will be discussed in the next issue of *The Connection*.

For a list of references used in this article and more information, visit this website:

[dnr.mo.gov/geology/geosrv/imac/stpetersandstone.htm](http://dnr.mo.gov/geology/geosrv/imac/stpetersandstone.htm)

## Staff News

### Debbie Stogsdill Retires

Debbie Stogsdill, Section Secretary, retired at the end of June 2013. Debbie started working for the Wellhead Protection Section in October 2007 as an Office Support Assistant, and in April 2009 was promoted to the position of Section Secretary. Upon retirement Debbie said, "Working with DNR, Wellhead Protection has been an amazing experience for me. I have learned so much over the years and met so many amazing people along the way. I am sad to say good bye to all my co-workers, and I am truly going to miss them all. Good bye, Debbie Stogsdill." Congratulations go out to Debbie upon her retirement. She will be greatly missed.



### Karen Smith promoted as Section Secretary



Karen Smith was promoted to the Section Secretary position July 1, 2013, filling the vacancy created by the retirement of Debbie Stogsdill. Karen has worked in the section as an Office Support Assistant since June 16, 2011. Prior to joining the division, Karen worked for several years at her family sawmill business and at Rolla

Technical Institute for six years. Karen said she looks forward to continuing her work assisting well owners and contractors and working to protect Missouri's groundwater. Please join us in welcoming Karen in her new role.

## Wellhead Protection Section Staff

Wellhead Protection Section: 573-368-2165

Website: [dnr.mo.gov/geology/geosrv/wellhd/job.htm](http://dnr.mo.gov/geology/geosrv/wellhd/job.htm)

Well Online Services: [dnr.mo.gov/mowells/](http://dnr.mo.gov/mowells/)

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## Data Available from the State of Missouri

Many permitted contractors, especially in the monitoring well industry, regularly use the Missouri Environmental Geology Atlas (MEGA) to look for wells located near a site that is being investigated. MEGA is no longer supported by the department and has not been updated since 2007, therefore providing incomplete information. Although the database of well records is available to search for well records online [[dnr.mo.gov/mowells/](http://dnr.mo.gov/mowells/)], there is not yet a mapping feature to aid in locating wells within a specified search distance from a location.

An updated version of the certified wells layer, which contains all wells certified by the division since November 1987, is available as a free download from the Missouri Spatial Data Information Service (MSDIS) [[msdis.missouri.edu](http://msdis.missouri.edu)]. It is a shapefile, which is a format designed by the geographic

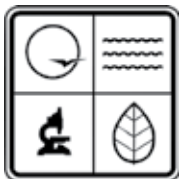
software company Environmental Systems Research Institute Inc. (ESRI) for use in programs such as ArcMap or ArcView. Other programs, including free, open-source programs such as ArcGIS Explorer [[esri.com/software/arcgis/explorer](http://esri.com/software/arcgis/explorer)], are available that can use these files to conduct spatial analysis. If you have questions about what software is available, please check with your organization's information technology staff.

The certified wells file is listed under "Inland Water Resources" on the MSDIS website [[msdis.missouri.edu/data/datalist.html](http://msdis.missouri.edu/data/datalist.html)]. MSDIS hosts many more files from DNR and other state agencies. Examples of additional DNR data that may be of interest include bedrock geology, surficial materials and structural features. Please refer to each file's metadata for more information.

## Wellhead Protection Section

We are here to ensure any new private well drilled in Missouri is constructed to minimum standards as set by state regulations. This helps protect our groundwater resources from contamination due to poor well construction. We regulate the construction of private water wells (this includes domestic and multiple family class wells), irrigation wells, monitoring

wells and heat pump wells. In addition, we regulate how to properly plug all types of wells. Our job is to balance the concerns of the land owner and the driller, while at the same time performing our overall directive of protecting Missouri's vast underground water supply from contamination due to improper construction and abandonment of wells.



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